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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte LARS LANGEMYR, MAGNUS MARKLUND,
ARNE NORDMARK, PER-OLOF PERSSON, and MAGNUS RINGH

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Appeal 2008-1495
Application 09/675,778
Technology Center 2100

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Decided: May 28, 2008

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Before MICHAEL R. FLEMING, *Chief Administrative Patent Judge*, and
LEE E. BARRETT, ALLEN R. MACDONALD, LINDA E. HORNER, and
JOHN A. JEFFERY, *Administrative Patent Judges*.

HORNER, Administrative Patent Judge.

DECISION ON APPEAL

STATEMENT OF THE CASE

Lars Langemyr et al. (Appellants) seek our review under 35 U.S.C. § 134 of the final rejection of claims 1, 3-87, and 89-101. The Appellants' counsel appeared before this panel for oral hearing on April 17, 2008. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

SUMMARY OF DECISION

We AFFIRM.

THE INVENTION

The Appellants' claimed invention is to techniques, simulation, and problem solving using a computer system (Spec. 1:13-14). Claims 1 and 42, reproduced below, are representative of the subject matter on appeal.

> 1.   A method executed in a computer apparatus for creating a model of a combined physical system having physical quantities by representing physical quantities of the combined physical system in terms of a combined set of partial differential equations, the method comprising:
>
> representing at least one of a plurality of systems as two or more selected application modes modeling physical quantities of said one of said plurality of systems;
>
> determining a set of partial differential equations for each of the two or more selected application modes, parameters of the partial differential equations being physical quantities of corresponding ones of said plurality of systems;

forming said combined set of partial differential equations using the determined sets of partial differential equations associated with said one of said plurality of systems; and

outputting a model of said combined physical system based on said combined set of partial differential equations for the two or more selected application modes for the said one of said plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system.

42.   A computer readable medium having stored thereon instructions for creating a model of a combined physical system having physical quantities by representing physical quantities of the combined physical system in terms of a combined set of partial differential equations comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:

representing at least one of a plurality of systems as two or more selected application modes modeling physical quantities of said one of said plurality of systems;

determining a set of partial differential equations for each of the two or more selected application modes, parameters of the partial differential equations being physical quantities of corresponding ones of said plurality of systems;

forming said combined set of partial differential equations using sets of partial differential equations associated with said one of said plurality of systems; and

> outputting a model of said combined physical
> system based on said combined set of partial
> differential equations for the two or more selected
> application modes for the said one of said plurality
> of systems, whereby the model represents a
> mathematical expression of the physical quantities
> of the combined physical system.

THE REJECTION

The Appellants seek our review of the Examiner's rejection of claims 1, 3-87, and 89-101 under 35 U.S.C. § 101 as being directed to non-statutory subject matter.

ISSUE

The issue before us is whether the Appellants have shown that the Examiner erred in rejecting claims 1, 3-87, and 89-101 under 35 U.S.C. § 101 as directed to non-statutory subject matter. This issue turns, in part, on whether ineligible mathematical manipulations of data become eligible subject matter when the manipulations are performed on a computer, where the data represents physical systems, and where the method includes a step of outputting a model. This issue further requires us to decide whether ineligible mathematical manipulations of data become eligible subject matter when the mathematical manipulations are stored on a computer readable medium. This issue still further requires us to determine whether ineligible mathematical manipulations of data become eligible subject matter when the input data is obtained via a graphical user interface and/or stored in an unspecified data structure or when the output is displayed on a graphical user interface.

PRINCIPLES OF LAW

The "useful arts" in the Constitution are implemented by Congress in the statutory categories of eligible subject matter in 35 U.S.C. § 101. Section 101 states, "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title." 35 U.S.C. § 101 (2002). "[N]o patent is available for a discovery, however useful, novel, and nonobvious, unless it falls within one of the express categories of patentable subject matter of 35 U.S.C. § 101." *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 483 (1974). The Supreme Court cases prove that § 101 is as much a statutory requirement of patentability as §§ 102, 103, and 112.

Although it has been said that through the 1952 Patent Act "Congress intended statutory subject matter to include anything under the sun that is made by man," *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (quoting S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952); H.R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952) (internal quotation marks omitted)), the Supreme Court has said that this statement does "not … suggest that § 101 has no limits or that it embraces every discovery." *Id.* "The *obligation* to determine what type of discovery is sought to be patented [so as to determine whether it is "the kind of 'discoveries' that the statute was enacted to protect"] *must precede* the determination of whether that discovery is, in fact, new or obvious." *Parker v. Flook*, 437 U.S. 584, 593 (1978) (emphases added).

Section 101 does not provide that a process can simply be a plurality of steps or any method; the courts have rejected such an interpretation. In fact, the Supreme Court has pointed out that its decisions have foreclosed an ordinary, dictionary reading of "process." *See Flook*, 437 U.S. at 589 ("The holding that the discovery of [*Benson*'s] method could not be patented as a 'process' forecloses a purely literal reading of § 101.").

In *Diamond v. Diehr*, the Supreme Court performed a lengthy statutory construction treatment of the term "process" in section 101. 450 U.S. at 181-84. The Supreme Court noted that the term "process" was not formally a category of statutory subject matter until 1952 when Congress inserted that term in section 101 in exchange for the word "art." *Id.* at 182. Nevertheless, a number of Supreme Court cases, dating back to the 19th century, recognized that processes were patent-eligible because they were considered a form of "art" as that term was used in the 1793 Patent Act. *See id.* at 182. After quoting passages from those earlier cases[1] expounding on the long-standing meaning of "process," the *Diehr* Court concluded that the 1952 Patent Act essentially codified the Court's pre-existing definition of that term: "Analysis of the eligibility of a claim of patent protection for a 'process' did not change with the addition of that term to § 101." *Id.* at 184. And the Court repeated the definition of "process" it had recently given in *Gottschalk v. Benson*, 409 U.S. 63 (1972): "Transformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a

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[1] *Corning v. Burden*, 56 U.S. 252 (1853), and *Cochrane v. Deener*, 94 U.S. 780, 788 (1877).

process claim that does not include particular machines." *Diehr*, 450 U.S. at 184 (quoting *Benson*, 409 U.S. at 70).[2]

The Federal Circuit recently quoted with approval this test from *Diehr* as the standard for a statutory process. *See In re Comiskey*, 499 F.3d 1365, 1377 (Fed. Cir. 2007) (request for rehearing *en banc* pending) (quoting same test from *Diehr*). In addition, in *In re Schrader*, 22 F.3d 290 (Fed. Cir. 1994), the Federal Circuit had previously embraced the *Diehr* Court's interpretation of "process," coming to the independent conclusion that Congress incorporated the Supreme Court's already established meaning of "process" into the 1952 Patent Act. *Id.* at 295-96 (citing *Astoria Federal Sav. and Loan Ass'n v. Solimino*, 501 U.S. 104, 106-08 (1991) as standing for the "presumption that well-established common law principles are left unchanged by statutory enactment."); *see also id.* at 295 n.11.

The Supreme Court has also indicated, however, that its current test for a section 101 process is not necessarily forever fixed or permanent:

> It is argued that a process patent must either be tied to a particular machine or apparatus or must operate to change articles or materials to a 'different state or thing.' We do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents.

Benson, 409 U.S. at 71. Rather, the Court made clear that it could be open to revisiting the standard if a new, unforeseen technology warranted an

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[2] *See also Flook*, 437 U.S. at 588 n.9 ("this Court has only recognized a process as within the statutory definition when it either was tied to a particular apparatus or operated to change materials to a 'different state or thing.'") (citing *Cochrane*, 94 U.S. at 787-88).

exception to its test. *Id.* (explaining that it did not wish to "freeze process patents to old technologies, leaving no room for the revelations of new, onrushing technology."). The long-standing *Diehr* test for processes, however, has provided a reliable, workable set of legal principles, and nothing in Appellants' claimed method suggests that this case is sufficiently different from the claims to mathematical algorithms of *Benson* and *Flook* that would require us to depart from the *Diehr* test.

Moreover, the Supreme Court's construction of "process" appropriately keeps the scope of that statutory category *in pari materia* with the other three categories of inventions – manufacture, machine, and composition of matter. Indeed, *Comiskey* expressly recognized a direct relationship between "process" and the other categories, observing that a method claim recites statutory subject matter only if "it is embodied in, operates on, transforms, or otherwise involves another class of statutory subject matter, *i.e.*, a machine, manufacture, or composition of matter." *Comiskey*, 499 F.3d at 1376 (restating the Supreme Court's transformation or tied to a particular apparatus test for "process").

As the *Comiskey* court observed, such an interpretation advances the Congressional and Constitutional intention that the patent system be directed to protecting technological innovations. *See id.* at 1375, 1378-79. Although the Federal Circuit's predecessor held that the question whether an invention is in the "technological arts" does not by itself constitute the test for patent-eligibility under section 101 (*see In re Toma*, 575 F.2d 872 (CCPA 1978)), the technological focus of the Patent Act and the Patent Clause informs the outer limits of subject matter eligibility under section 101. *See In re Bergy*,

596 F.2d 952, 959 (CCPA 1979) ("the present day equivalent of the term 'useful arts' employed by the Founding Fathers is 'technological arts' "), citing *In re Musgrave*, 431 F.2d 882 (CCPA 1970)), vacated, 444 U.S. 1028, aff'd sub nom., *Diamond v. Chakrabarty*, 447 U.S. 303 (1980).

The Supreme Court recently reaffirmed that patents may issue only for those innovations that promote "the progress of useful arts." *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1746 (2007). In this regard, usages of the term "useful arts" contemporaneous with the framing of the Constitution uniformly tie "useful arts" to manufactures and manufacturing processes, thereby providing strong support for the notion that "process" must be interpreted in parity with the other statutory categories.[3]

Against this background, it is unlikely that Congress intended the boundaries of "process" to be so expansive as to accommodate all methods

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[3] *See generally* Daniel Defoe, *A General History of Discoveries and Improvements in Useful Arts* (1727) (providing a history of technological developments from biblical times); W. Kenrick, *An Address to the Artists and Manufacturers of Great Britain* (1774) (contrasting the "useful arts" with the "polite arts"); Tench Coxe, *An Address to an Assembly of the Friends of American Manufactures, in Calling for More Domestic Manufacturing* (1787), at 17 (tying "useful arts" to manufactures); id. at 18 (describing progress in the useful arts as having produced improvements in numerous kinds of manufactures, from ships to whips to watches); George Logan, M.D., *A Letter to the Citizens of Pennsylvania, on the Necessity of Promoting Agriculture, Manufactures, and the Useful Arts* (1800) 12-13 (tying "useful arts" to manufacturing processes, and observing the connection between a country's prosperity and the progress in the useful arts); Karl B. Lutz, *Patents and Science*, 18 Geo. Wash. L. Rev. 50, 54 (1949) ("The term 'useful arts,' as used in the Constitution ... is best represented in modem language by the word 'technology.' ").

that have a use. Rather, we adhere to the rule that, at least absent the development of some hitherto unknown type of technology, "[t]ransformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines." *Diehr*, 450 U.S. at 184 (quoting *Benson*, 409 U.S. at 70).

Whether a method appropriately includes particular machines to qualify as a section 101 process may not always be a straightforward inquiry. As *Comiskey* recognized, "the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter." *Comiskey*, 499 F.3d at 1380 (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)). In other words, nominal or token recitations of structure in a method claim should not convert an otherwise ineligible claim into an eligible one. For the same reason, claims reciting incidental physical transformations also may not pass muster under section 101. To permit such a practice would exalt form over substance and permit claim drafters to file the sort of process claims not contemplated by the case law.

In *Benson*, the Court reviewed the facts of several of its precedents dealing with process patents before drawing the conclusion that "transformation" is the clue to patent-eligibility "of a process claim that does not include *particular machines*." *Benson*, 409 U.S. at 68-71 (emphasis added). Of the cases discussed, *Corning* (tanning and dyeing), *Cochrane* (manufacturing flour), *Tilghman v. Proctor*, 102 U.S. 707 (1880) (manufacturing fat acids), and *Expanded Metal Co. v. Bradford*, 214 U.S.

366 (1909) (expanding metal), can all fairly be read to involve transformation of some article or material to a different state or thing. *Id.* at 69-70. *Benson* also compared *O'Reilly v. Morse*, 56 U.S. (15 How.) 62 (1854), to *The Telephone Cases*, 126 U.S. 1 (1888), reasoning that Morse's eighth claim was disallowed because it failed to recite any machinery for carrying out the printing of characters at a distance, instead simply claiming the use of "electromagnetism, however developed" for that purpose. *Id.* at 68. In contrast, Bell's claim in *The Telephone Cases* recited certain specified conditions for using a particular circuit for the transmission of sounds. *Benson*, 409 U.S. at 68-69.

These cases illustrate process claims where the recited machines played a central role in generating a useful result. In direct contrast, human-driven methods that merely recite a device that is insignificant to accomplishing the method (like the claim in *Grams*) and do not transform any article should not be recognized as a "process" claim similar to the above-cited cases. *See Diehr*, 450 U.S. at 191-92 ("insignificant post-solution activity will not transform an unpatentable principle into a patentable process. To hold otherwise would allow a competent draftsman to evade the recognized limitations on the type of subject matter eligible for patent protection.")

We acknowledge that it will not always be simple to draw the line between a statutory process appropriately "tied to a particular apparatus" and a nonstatutory method with nominal recitations of structure, but such a standard is necessary to prevent clever claim drafting from circumventing the principles underlying the Supreme Court's interpretation for "process."

In *Benson*, the patent claims were directed to a method for converting binary-coded-decimal (BCD) numerals into pure binary numerals for use with a general-purpose digital computer of any type. 409 U.S. at 64. The question before the Court was "whether the method described and claimed is a 'process' within the meaning of the Patent Act." *Id.* The Court characterized the claimed invention as "a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another." *Id.* at 65. The Court found that the "process" claim was "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure binary conversion." *Id.* at 68. The Court found that "[t]he end use may (1) vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents and (2) be performed through any existing machinery or future-devised machinery or without any apparatus." *Id.* The Court thus held that the claimed method was directed to non-statutory subject matter, because "[t]he mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." *Id.* at 71-72.

In *Flook*, the patent claims were directed to a method of updating alarm limits. 437 U.S. at 585. The Court found that "[t]he only difference between the conventional methods of changing alarm limits and that described in respondent's application rests in the second step – the mathematical algorithm or formula." *Id.* at 585-86. The Court noted that

the claims did not "cover every conceivable application of the formula." *Id.*
at 587. As such, the Court agreed that the claims did not seek to wholly
preempt the mathematical formula. *Id.* at 589-90. Nonetheless, the Court
held that the claimed method was directed to non-statutory subject matter,
because "a claim for an improved method of calculation, even when tied to a
specific end use, is unpatentable subject matter under § 101." *Id.* at 595
n.18. In doing so, the Court rejected the respondent's assumption that "if a
process application implements a principle in some specific fashion, it
automatically falls within the patentable subject matter of § 101." *Id.* at 593.
The Court stated that this assumption "would make the determination of
patentable subject matter depend simply on the draftsman's art and would ill
serve the principles underlying the prohibition against patents for 'ideas' or
phenomena of nature." *Id.* The Court summarized the basis for its holding
as follows:

> Even though a phenomenon of nature or
> mathematical formula may be well known, an
> inventive application of the principle may be
> patented. Conversely, the discovery of such a
> phenomenon cannot support a patent unless there
> is some other inventive concept in its application.

Id. at 594.

In *Diehr*, the claimed invention was directed to a process for curing
synthetic rubber. The question before the Court was "whether a process for
curing synthetic rubber which includes in several of its steps the use of a
mathematical formula and a programmed digital computer is patentable
subject matter under 35 U.S.C. § 101." *Id.* at 177. In the claimed process,
the actual temperature in the mold is constantly measured, and these

measurements are fed back to the computer to use to repeatedly recalculate the cure time using the Arrhenius equation, so that when the recalculated time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press. *Id.* at 178-79. The continuous measuring of the temperature inside the mold cavity, the feeding of this information to a digital computer which constantly recalculates the cure time, and the signaling by the computer to open the press, were all new in the art. *Id.* at 179. The patent examiner rejected the claims, finding that the steps carried out by the computer were non-statutory subject matter under *Benson* and the remaining steps of installing the rubber in the press and closing the press were merely conventional. *Id.* at 180-81. The Patent and Trademark Office Board of Appeals agreed with the examiner, but the Court of Customs and Patent Appeals reversed. *Id.* at 181. On review, the Supreme Court held that a physical and chemical process for molding precision synthetic rubber products falls within the § 101 categories of possibly patentable subject matter, because the claims involve a transformation of an article into a different state or thing and "[i]ndustrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws." *Id.* at 184. The Court cited with approval its previous statement in *Benson* that "[t]ransformation and reduction of an article to a different state or thing is the clue to the patentability of a process claim that does not include particular machines." *Id.* (quoting *Benson*, 409 U.S. at 70 (internal quotation marks omitted)). In contrast to the facts in *Flook*, the Court noted:

> [T]he respondents here do not seek to patent a
> mathematical formula. Instead, they seek patent
> protection for a process of curing synthetic rubber.
> Their process admittedly employs a well-known
> mathematical equation, but they do not seek to pre-
> empt the use of that equation. Rather, they seek
> only to foreclose from others the use of that
> equation in conjunction with all of the other steps
> in their claimed process.

Id. at 187. The Court concluded that "a claim drawn to subject matter

otherwise statutory, does not become nonstatutory simply because it uses a

mathematical formula, computer program, or digital computer." *Id.* The

Court also stated the corollary, as follows:

> A mathematical formula does not suddenly
> become patentable subject matter simply by having
> the applicant acquiesce to limiting the reach of the
> patent for the formula to a particular technological
> use. A mathematical formula in the abstract is
> nonstatutory subject matter regardless of whether
> the patent is intended to cover all uses of the
> formula or only limited uses. Similarly, a
> mathematical formula does not become patentable
> subject matter merely by including in the claim for
> the formula token postsolution activity such as the
> type claimed in *Flook*.

Id. at 192 n.14.

For a process to be deemed patent-eligible under section 101,

Diamond v. Diehr, 450 U.S. 175 (1981) requires that two *separate* inquiries

must take place. First, the claim must qualify as a "process," as that term

has been interpreted by the courts. *Id.* at 181-84. Second, even if the claim

satisfies the Supreme Court's definition for "process," the claim must then

be evaluated for whether it is for an abstract idea, natural phenomenon, or

law of nature. *Id.* at 185-93. When conducting the section 101 analysis, the claims must be examined "as a whole." *Id.* at 188.

In *Comiskey,* the Federal Circuit stated that "Supreme Court decisions after the 1952 Patent Act have rejected a 'purely literal reading' of the process provision and emphasized that not every 'process' is patentable." *Id.* at 1375 (quoting *Flook*, 427 U.S. at 589). Rather "[t]he question is whether the method described and claimed is a 'process' within the meaning of the Patent Act." *Id.* (quoting *Gottschalk v. Benson*, 409 U.S. 63, 64 (1972)). The court held that claims directed to a method for mandatory arbitration resolution were unpatentable under § 101 because "the patent statute does not allow patents on particular systems that depend for their operation on human intelligence alone, a field of endeavor that both the framers and Congress intended to be beyond the reach of patentable subject matter." *Id.* at 1378-79. The court stated:

> The prohibition against the patenting of abstract ideas has two distinct (though related) aspects. First, when an abstract concept has no claimed practical application, it is not patentable.
>
> …
>
> Second, the abstract concept may have a practical application. The Supreme Court has reviewed process patents reciting algorithms or abstract concepts in claims directed to industrial processes. In that context, the Supreme Court has held that a claim reciting an algorithm or abstract idea can state statutory subject matter only if, as employed in the process, it is embodied in, operates on, transforms, or otherwise involves

> another class of statutory subject matter, i.e., a
> machine, manufacture, or composition of matter.
> 35 U.S.C. § 101.

Id. at 1376.

ANALYSIS

Claim Groupings

The Appellants argue independent claims 1 and 82 as a first group (App. Br. 8), and independent claims 42 and 92 as a second group (App. Br. 10). The Appellants also make a passing reference to dependent claims 10, 13, 14, and 26 (App. Br. 8-9), and to dependent claims 50, 53, 54, and 66 (App. Br. 10). It is unclear whether the Appellants intended to separately argue these dependent claims, because the Appellants enumerate these dependent claims under the same heading used to argue their respective independent claims.[1] The Appellants present no separate arguments for patentability of dependent claims 3-9, 11, 12, 15-25, 27-41, 43-49, 51, 52, 55-65, 67-81, 83-87, 89-91, and 93-101. Thus, we treat claim 1 as representative of the claims of the first group, and claims 3-9, 11, 12, 15-25, 27-41, 82-87, and 89-91 stand or fall with claim 1. We treat claim 42 as representative of the claims of the second group, and claims 43-49, 51, 52, 55-65, 67-81, and 92-101 stand or fall with claim 42. We treat dependent claims 10 and 50 as a third group[2], claims 13 and 53 as a fourth group[3],

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[1] 37 C.F.R. § 41.37(c)(1)(vii) states, in pertinent part, "Any claim argued separately should be placed under a subheading identifying the claim by number."

[2] Claims 10 and 50 depend from claims 1 and 42, respectively, and further recite the steps of (1) displaying a partial differential equation in one of a:

claims 14 and 54 as a fifth group[4], and claims 26 and 66 as a sixth group[5].

Group 1

　　　　We first consider whether claim 1 recites a patentable "process" within the meaning of § 101. As noted *supra*, this issue turns on whether ineligible mathematical manipulations of data become eligible subject matter when the manipulations are performed on a computer, where the data represents physical systems, and where the method includes a step of outputting a model. Appellants' claim 1 calls for a method executed in a computer apparatus for creating a mathematical expression of a combined physical system having physical quantities by representing physical quantities of the combined physical system in terms of a combined set of partial differential equations comprising:

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coefficient view and a general form corresponding to a representation of said partial differential equation; and (2) modifying a portion of said partial differential equation.

[3] Claims 13 and 53 depend from claims 10 and 50, respectively, and further recite the step of obtaining data using a graphical user interface in connection with said one of said plurality of systems.

[4] Claims 14 and 54 depend from claims 10 and 50, respectively, and further recite the step of using a graphical user interface to display and input data.

[5] Claims 26 and 66 depend from claims 1 and 42, respectively, and further recite the steps of (1) using a graphical user interface in connection with input data; (2) storing said input data in a representation in a data structure stored in a memory of the computer system; and (3) converting said input data into an intermediate form wherein said intermediate form for each set of partial differential equations associated with said one of said plurality of systems is used in forming said combined set.

> representing at least one of a plurality of systems as two or more selected application modes modeling physical quantities of said one of said plurality of systems;
>
> determining a set of partial differential equations for each of the two or more selected application modes, parameters of the partial differential equations being physical quantities of corresponding ones of said plurality of systems;
>
> forming said combined set of partial differential equations using the determined sets of partial differential equations associated with said one of said plurality of systems; and
>
> outputting a model of said combined physical system based on said combined set of partial differential equations for the two or more selected application modes for the said one of said plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system.

As explained *infra*, Appellants' method claim is not a section 101 "process," because it does not include a particular machine, nor does it transform subject matter to a different state or thing. A statutory "process" must meet one of those two requirements.

While Appellants' claim encompasses a "particular machine" embodiment for creating a mathematical expression of a combined physical system, the claim is not limited to such an embodiment. Appellants' claimed method steps, as recited in the body of claim 1, are not limited to process steps using particular structure or apparatus. To the contrary, looking only to the method steps recited in the body of claim 1, they would reasonably be interpreted to encompass a human being performing these

steps. The Appellants' claim 1 preamble includes only a nominal recitation of a "computer apparatus." Nominal recitations of structure in an otherwise ineligible method fail to make the method a statutory process. *See Benson*, 409 U.S. at 71-72. As *Comiskey* recognized, "the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter." *Comiskey*, 499 F.3d at 1380 (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)). Incidental physical limitations, such as data gathering, field of use limitations, and post-solution activity are not enough to convert an abstract idea into a statutory process. In other words, nominal or token recitations of structure in a method claim do not convert an otherwise ineligible claim into an eligible one. To permit such a practice would exalt form over substance and permit claim drafters to file the sort of process claims not contemplated by the case law. *Cf., Flook*, 437 U.S. at 593 (rejecting the respondent's assumption that "if a process application implements a principle in some specific fashion, it automatically falls within the patentable subject matter of § 101," because allowing such a result "would make the determination of patentable subject matter depend simply on the draftsman's art and would ill serve the principles underlying the prohibition against patents for 'ideas' or phenomena of nature."). In this case, we decline to allow clever claim drafting to circumvent the principles underlying the Supreme Court's interpretation for "process." The only recitation of structure is in the nominal recitation in the preamble citing a "method executed in a computer apparatus." This recitation is so generic as to encompass any computing system, such that anyone who performed this method in practice would fall within the scope of these claims. Thus, the

recitation of a computer apparatus in the preamble is not, in fact, a limitation at all to the scope of the claim, and the claim is directed, in essence, to the method performed by any means. As such, we fail to find that this recitation alone requires the claimed method to include a particular machine such that the method qualifies as a "process" under § 101. We will not allow such a nominal recitation in the preamble to convert an otherwise ineligible claim into an eligible one.

Moreover, the creation of intangible mathematical expressions is far different from the transformation of subject matter contemplated by the Supreme Court cases. Appellants' claim 1 calls only for the creation of a mathematical expression.

Appellants' claim 1 recites "outputting a model of said combined physical system based on said combined set of partial differential equations for the two or more selected application modes for the said one of said plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system." Here we do not have a transformation of subject matter but merely an abstract mathematical expression that is created from the previous steps. The model is merely a combined set of partial differential equations, and does not require any physical output into the real world. Just as with *Comiskey's* disembodied arbitration method, therefore, Appellants' method of outputting a model using partial differential equations likewise fails to recite a statutory process.

The definition in 35 U.S.C. § 100(b) that a "process" includes "a new use of a known … machine," requires that new uses of a known machine be

claimed as a method. We do not think the statute states that any inclusion of a machine makes a method a statutory "process." The steps of claim 1 transform mathematical expressions by combining sets of partial differential equations and do not transform physical subject matter to another state or thing. As explained *supra*, the limitation that the method is "executed in a computer apparatus" does not tie the method to a "particular machine." Any and all computing systems will suffice, indicating that the claim is not directed to the function of any particular machine.

We further consider whether claim 1 is directed to one of these judicially-recognized exclusions to patentable subject matter. We find that Appellants' claim 1 constitutes the disembodied abstract idea for creating a mathematical expression of a combined physical system (either an actual physical system or a theoretical physical system). In other words, the claim fails to recite a practical application of that concept, as further explained below. While Appellants' claim may yield a beneficial result with respect to modeling a system, a proper section 101 analysis is not driven solely by usefulness.

The method steps of claim 1 are directed only to a manipulation of abstract ideas implemented by any machine that calculates. In other words, a careful review of claim 1 reveals that the steps embody only the idea of modeling a system using partial differential equations itself, and "wholly pre-empt" all uses of this abstract idea such that the practical effect is a patent on the idea itself. *See Benson*, 409 U.S. at 71-72; *see also Diehr*, 450 U.S. at 187.

We find the facts presented by this case are strikingly similar to the facts in *Benson*. In *Benson*, the claims were directed to a method for converting binary-coded-decimal (BCD) numerals into pure binary numerals for use with a general-purpose digital computer of any type. *Benson*, 409 U.S. at 64. In *Benson*, the method steps in the body of the claim incorporated portions of the computer such as shift registers into the steps. The question before the Court was "whether the method described and claimed is a 'process' within the meaning of the Patent Act." *Id.* The Court characterized the claimed invention as "a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another." *Id.* at 65. The Court found that the "process" claim was "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure binary conversion." *Id.* at 68. The Court found that "[t]he end use may (1) vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents and (2) be performed through any existing machinery or future-devised machinery or without any apparatus." *Id.* The Court thus held that the claimed method was directed to non-statutory subject matter, because "[t]he mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." *Id.* at 71-72.

The claimed algorithm in the present case is similar. The claim attempts to patent an algorithm for creating a mathematic representation of a

system which has no substantial practical application except in connection with a digital computer. As in *Benson*, the steps of Appellants' claim 1 are so abstract and sweeping as to cover both known and unknown uses of the method of modeling a physical system using a combined set of partial differential equations. *See Benson*, 409 U.S. at 68. The end use of this abstract idea is applicable to a wide variety of unrelated applications. For example, it can be used to model a variety of systems using, e.g., acoustics models, chemical reactions models, electromagnetic models, fluid dynamics models, geophysics models, heat transfer models, etc. (App. Br. 4). Further, the method can be performed through any existing machinery or future-devised machinery or without any apparatus. *See id.* Thus, a patent directed to the claimed method would wholly pre-empt the abstract idea and in practical effect would be a patent on the algorithm itself.

Thus, the claimed method is not tied to "a particular machine," but rather is tied only to a general purpose computer. As in *Benson*, where the recitation of storing binary coded decimal signals in a reentrant shift register and then manipulating the signals in the register did not make the computer a "particular machine," likewise in the present claimed method, the general recitation of a "computer" should not convert otherwise non-statutory subject matter into patentable subject matter. *See Benson*, 409 U.S. at 70 ("Transformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines"), *cited with approval in Diehr*, 450 U.S. at 184. Claims that involve machines in a merely incidental fashion are not automatically directed to a patentable process. We find this similar to a claim directed to a

law of nature, such as F = MA, where the applicant recites in the claim that this method of calculation is performed on a computer. The elements of this equation correspond to actual physical systems, for example M = mass of a physical object. However, it would be contrary to tenets of *Benson* and *Flook* to determine that such a claim recites statutory subject matter simply by virtue of using a computer to solve the equation.

The Appellants argue that their claim does not wholly preempt every practical application of a mathematical algorithm because the claim was narrowed during prosecution to avoid the prior art (App. Br. 9). The law does not require, however, that every conceivable use be preempted for the claim to be unpatentable. Rather, it is enough that the unpatentable subject matter recited in the claim has "no substantial practical application" outside the context of the claims. *Benson*, 409 U.S. at 71-72. In *Benson*, the Court found that the mathematical formula involved in that case had "no substantial practical application except in connection with a digital computer." *Id.* Thus, a patent which claimed "a method of programming a general-purpose digital computer to convert signals from binary-coded decimal form into pure binary form" through the use of a mathematical formula would "wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." *Id.* at 65, 71-72.

The same is true here. Because the claimed abstract idea has no substantial practical application except in connection with a digital computer, it does not matter that uses outside of this context are not foreclosed. The Appellants argued at the oral hearing that the claimed method could theoretically be performed by hand (Transcript 8). We find,

however, that while the use of a computer is not a necessity, modeling complex physical systems by combining partial differential equations by hand is not a substantial practical application of the claimed method, as it would be unreasonable to expect those in the art to regularly perform these complex manipulations without the aid of a computer. To the extent that the Appellants are arguing that their claimed method is directed to an improved method of creating a model, i.e., using two or more application modes to create a combined set of partial differential equations, even still under *Flook* such an improved method of calculation is unpatentable subject matter under § 101. 437 U.S. at 595 n.18.

The body of claim 1 recites the steps of representing a system as two or more application modes modeling physical quantities of the system, determining a set of partial differential equations for the application modes, forming a combined set of partial differential equations, and outputting a model. These steps describe nothing more than the manipulation of basic mathematical constructs, the paradigmatic "abstract idea." *See In re Warmerdam*, 33 F.3d 1354, 1360 (Fed. Cir. 1994). The Appellants' argument that the claim requires output of a model misses the point. As a whole, the claim involves no more than the manipulation of abstract ideas. *See id.*

Moreover, the outputting step is indistinguishable from the insignificant post-solution activity step, which the Supreme Court in *Flook* found was insufficient, standing alone, to impart patentability to a claim. *Flook*, 437 U.S. 584, 588-90 (1978), *cited with approval in Diehr*, 450 U.S. at 191-92). An unpatentable principle will not transform into a patentable

process simply by adding conventional method steps. *Flook*, 437 U.S. at
588-90; *see also Diehr*, 450 U.S. at 191-92.

Similarly, the Appellants' argument that the claim is statutory because
it models a physical system is equally unavailing. Regardless of whether the
claim uses the mathematical constructs to model an actual physical system
(as in *Flook*) or a theoretical physical system, the claim is still directed to the
mathematical manipulations used to create the model. As explained *supra*,
we see no difference between the Appellants' claimed method and a claim
directed to performing a calculation, such as F=MA, on a computer, in
which the variables in the calculation correspond to physical systems.

We further note that this claim would fail even under the "useful,
concrete, and tangible result" test, as explained in *State St. Bank & Trust Co.
v. Signature Fin. Group, Inc.*, 149 F.3d 1368 (Fed. Cir. 1998), because the
output provided in claim 1 does not relate to any system in the real world.
Rather, the claim is directed to forming the mathematical equations that will
be used at some later time to model a system. The particular system being
modeled is not claimed. As such, the output of claim 1 is an abstraction with
no practical, real-world application being claimed.

Accordingly, we hold that claim 1 is directed to non-statutory subject
matter and is unpatentable under 35 U.S.C. § 101. Claims 3-9, 11, 12,
15-25, 27-41, 82-87, and 89-91 fall with claim 1.

Group 2

Claim 42 includes steps identical to claim 1 in the body of the claim; the only difference between the claims resides in the preamble. Claim 42 is directed to a computer readable medium having stored thereon instructions for creating a model of a combined physical system having physical quantities by representing physical quantities of the combined physical system in terms of a combined set of partial differential equations comprising machine executable code which when executed by at least one processor, causes the processor to perform the recited steps. This claim requires us to decide whether ineligible mathematical manipulations of data become eligible subject matter when the mathematical manipulations are stored on a computer readable medium.

Simply placing instructions on a computer readable medium, wherein the instructions are designed to perform mere manipulations of abstract ideas, should not convert an otherwise non-statutory method into patentable subject matter. Regardless of the format of the claim, we must still examine whether the claimed computer readable medium falls under one of the judicially-created exceptions to patentable subject matter, i.e., laws of nature, natural phenomena, and abstract ideas. *See Diehr*, 450 U.S. at 185 (citations omitted).

We see no reason why placing instructions on a computer readable medium that cause a processor, when executed, to engage in manipulations of abstract ideas should be treated any differently from the method of claim 1. The body of claim 42, as in claim 1, recites the steps of representing a system as two or more application modes modeling physical

quantities of the system, determining a set of partial differential equations for the application modes, forming a combined set of partial differential equations, and outputting a model. As in claim 1, the steps of claim 42 describe nothing more than the manipulation of basic mathematical constructs, and the claimed outputting step is insignificant post-solution activity. There is also no transformation in the subject matter of claim 42, because the claim merely recites instructions stored on a computer readable medium. Although the instructions, when executed in a computer, may cause a transformation of the computer, *see e.g., In re Alappat*, 33 F.3d 1526 (Fed. Cir. 1994); *In re Iwahashi*, 888 F.2d 1370 (Fed. Cir. 1989) (both finding that loading a novel computer program into computer memory created a "new machine" with a different physical arrangement of gates), the step of executing the instructions in a computer is not claimed here. In other words, the claim is not directed to a computer or machine loaded with and/or executing the software. We are not saying, by this distinction, that such a claim would necessarily be patentable in this case either. We are not, however, confronted with such a machine claim, and thus we decline to rule on whether such a claim would be directed to statutory subject matter.

Accordingly, we hold that claim 42 is directed to an abstract idea and is thus unpatentable under 35 U.S.C. § 101. Claims 43-49, 51, 52, 55-65, 67-81, and 92-101 fall with claim 42.

Group 3

Claims 10 and 50 depend from claims 1 and 42, respectively, and further recite the steps of (1) displaying a partial differential equation in one of a: coefficient view and a general form corresponding to a representation of said partial differential equation; and (2) modifying a portion of said partial differential equation. The Appellants seem to imply, by the underlined portion of their Brief on pages 9 and 10, that the recitation of <u>displaying</u> is sufficient to render the subject matter of claims 10 and 50 patentable. These claims require us to determine whether ineligible mathematical manipulations of data become eligible subject matter when the mathematical equations are displayed.

Nominal or token recitations of structure in a claim do not convert an otherwise ineligible claim into an eligible one. *See e.g., Comiskey*, 499 F.3d at 1380 ("the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter") (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)). For the same reason, claims reciting incidental physical transformations do not pass muster under section 101. To permit such a practice would exalt form over substance and permit claim drafters to file the sort of claims not contemplated by the case law. The Appellants' recitation of displaying the partial differential equation is nothing more than an incidental physical transformation of a display that has no bearing on the method of creating the model as claimed.

Accordingly, we hold that claims 10 and 50 are not directed to statutory subject matter and are thus unpatentable under 35 U.S.C. § 101.

Group 4

Claims 13 and 53 depend from claims 10 and 50, respectively, and further recite the step of obtaining data using a graphical user interface in connection with said one of said plurality of systems. The Appellants seem to imply, by the underlined portion of their Brief on pages 9 and 10, that the recitation of obtaining data using a graphical user interface is sufficient to render the subject matter of claims 13 and 53 patentable. These claims require us to determine whether ineligible mathematical manipulations of data become eligible subject matter when the input data is obtained using a graphical user interface.

The same reasoning as set forth *supra* for claims 10 and 50 applies equally to claims 13 and 53. In particular, nominal or token recitations of structure in a claim and claims reciting incidental physical transformations do not convert an otherwise ineligible claim into an eligible one. *See e.g., Comiskey*, 499 F.3d at 1380 ("the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter") (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)). In this case, the use of a graphical user interface to collect input data does not turn the subject matter of claims 13 and 53 into statutory subject matter.

Accordingly, we hold that claims 13 and 53 are not directed to statutory subject matter and are thus unpatentable under 35 U.S.C. § 101.

Group 5

Claims 14 and 54 depend from claims 10 and 50, respectively, and further recite the step of using a graphical user interface to display and input data. The Appellants seem to imply, by the underlined portion of their Brief on pages 9 and 10, that the recitations of <u>displaying</u> and using a <u>graphical user interface</u> are sufficient to render the subject matter of claims 14 and 54 patentable. These claims require us to determine whether ineligible mathematical manipulations of data become eligible subject matter when the input data is obtained using a graphical user interface and when data is displayed on a graphical user interface.

The same reasoning as set forth *supra* for claims 10 and 50 applies equally to claims 14 and 54. In particular, nominal or token recitations of structure in a claim and claims reciting incidental physical transformations do not convert an otherwise ineligible claim into an eligible one. *See e.g., Comiskey*, 499 F.3d at 1380 ("the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter") (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)). In this case, the use of a graphical user interface to collect input data and display data does not turn the subject matter of claims 14 and 54 into statutory subject matter.

Accordingly, we hold that claims 14 and 54 are not directed to statutory subject matter and are thus unpatentable under 35 U.S.C. § 101.

Group 6

  Claims 26 and 66 depend from claims 1 and 42, respectively, and further recite the steps of (1) using a graphical user interface in connection with input data; (2) storing said input data in a representation in a data structure stored in a memory of the computer system; and (3) converting said input data into an intermediate form wherein said intermediate form for each set of partial differential equations associated with said one of said plurality of systems is used in forming said combined set. The Appellants seem to imply, by the underlined portion of their Brief on pages 9 and 10, that the recitations of obtaining data using a <u>graphical user interface</u> and <u>storing</u> input data in a <u>memory</u> of a computer system are sufficient to render the subject matter of claims 26 and 66 patentable. These claims require us to determine whether ineligible mathematical manipulations of data become eligible subject matter when the input data is obtained using a graphical user interface and when data is stored in an unspecified data structure.

  With regard to the use of a graphical user interface in connection with input data, the same reasoning as set forth *supra* for claims 10 and 50 applies equally to this limitation of claims 26 and 66. In particular, nominal or token recitations of structure in a claim and claims reciting incidental physical transformations do not convert an otherwise ineligible claim into an eligible one. *See e.g., Comiskey*, 499 F.3d at 1380 ("the mere use of the machine to collect data necessary for application of the mental process may not make the claim patentable subject matter") (citing *In re Grams*, 888 F.2d 835, 839-40 (Fed. Cir. 1989)).

With regard to the storing step, any machine and any data structure can be used to perform the steps recited in claims 26 and 66. The claim merely recites storing input data in a representation in a data structure stored in a memory of a computer system, but the claim does not specify any particular data structure. The Appellants' Specification does not require a specific data structure. Rather, the Specification describes, with reference to Figure 6A, an example of a representation of a data structure that could be used (Spec. 27:10-12).

The phrase "data structure" is defined as "[a] physical or logical relationship among data elements, designed to support specific data manipulation functions." *IEEE Standard Computer Dictionary* (1991). We see no way of storing data in a computer memory without storing it in some sort of data structure. The data structure of claim 26 is nothing more than another way of describing the manipulation of abstract ideas contained in claim 1, and thus it suffers from the same fatal defect as claim 1. *See Warmerdam*, 33 F.3d at 1362.

CONCLUSIONS OF LAW

We conclude the Appellants have failed to show that the Examiner erred in rejecting claims 1, 3-87, and 89-101 as unpatentable under 35 U.S.C. § 101.

DECISION

The decision of the Examiner to reject claims 1, 3-87, and 89-101 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2007).

AFFIRMED

vsh

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